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METHODS OF STUDYING LACHNOSTERNA.

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Owing to the large number of species contained in the genus Lachnosterna it is essential, for completeness, that studies be made in various parts of the United States, primarily to determine the length of the life cycle and, also, which species are economically most important. Doubtless the larvae of all species feed on the roots of living vegetation, but it is not known just which ones attack cultivated plants. Secondarily, to secure other details of the life history and habits, especially of the food habits of the beetles, time of appearance of those economically important in a given locality, periodicity of abundance, etc., all of which may be of value in devising means of control.

These notes are given in order that others of this division may become acquainted with our desires, know what methods have been found most satisfactory, and use the information should opportunity arise. We should like to learn of all contemplated Lachnosterna projects in order that special directions may be given to suit the locality.

The cages to be used may be either 12, 15, or 16 inch standard flowerpots, preferably 15 or 16 inch size, or wire screen cylinder cages. In using flowerpots care must be taken to keep the soil well watered, otherwise the soil will bake and the grubs be killed. As winter approaches, the wire cloth tops of such cages are removed and the tops of the pots covered with a straw and manure mulch. In the Southern States such a protection will probably not be required.

Several styles of wire-screen cages are available. These are cylindrical in shape and measure 20 inches in diameter and 30 inches in depth, with a cone-shaped cover to fit into the top of the cage. Probably the best type is made of 6-mesh #20 galvanized wire, covered on the inside with 18-mesh pearl (galvanized) wire cloth. Should the lighter pearl wire rust out before the beetles mature (supposedly in three years) the grubs will at least have become sufficiently large to make it impossible for them to escape through the 6-mesh screen, which is heavy and quite durable. A cage of the pearl wire cloth without the outer heavy wire screen may be used for studying the life cycle of the more southern species, which probably do not have a life cycle greater than two years; for such a cage will last at least two seasons. The cone-shaped tops of these cages are made of pearl wire cloth with suitable supports, with a basal band of galvanized iron to fit snugly into the top of the cage. The double wire cage, including top, costs about $6; the single wire cage, suitable for work in

the Southern States, about $4.50 or $5.

Another desirable cage is constructed of galvanized iron with an opening on either side 1 foot wide and 2 feet deep; that is, extending from 6 inches from the top to the bottom of the cage. The opening on each side is covered with 18-mesh brass wire cloth. This cage is the same size as the other screen cages mentioned and with the same kind of a top costs $5.

The pots, as well as the wire cages, are sunken in the ground and filled with sifted soil, care being taken not to introduce any foreign grubs. Some decaying cornstalks or rotten sod (which is free from grubs) is placed in the soil 6 inches or a foot from the surface. The top of the cage is sodded, and later some corn may be planted.

These underground cages, especially the flowerpot cages, will require more or less artificial watering during the summer; in fact much of the success of the experiment will depend on the proper moisture conditions. In late fall or early winter the tops of the flower pot cages should be removed and the cages covered with a straw and manure mulch in order to protect the grubs, since these do not, in these cages, have an opportunity to go down as deep as under natural conditions.

When possible three cages should be started for each species in order that one cage, or part of a cage, may be examined each season, assuming that the grubs have a two or three year cycle.

For obtaining material for use in rearing cages, beetles should be collected from trees at night, and it is advisable, where possible, to use only pairs taken in copula. These are not difficult to obtain, especially if search is made on warm evenings about 11 or 12 o'clock. For use in smaller pots one or two pairs are sufficient, two or three pairs for the 15 and 16 inch pots and three or four pairs for the 20-inch screen-wire cages.

Only external characters can be used in determining the male beetles for breeding cages, but in the case of females the organ may be extruded and examined by gently opening the anal flap with the thumb nail and at the same time pressing the abdomen gently but firmly with the thumb of the left hand. Usually the organ can be sufficiently examined when only partly extruded, thus eliminating the possibility of injuring the female.

Male beetles are usually distinguished from the females by having a more or less flattened area along the ventral median surface of the abdomen, and by the longer antennal lamellae. In some cases the male has a rounded and swollen abdomen the same as the female, for example, in Lachnosterna crenulata and L. rubiginosa.

Having placed the beetles in the cages it is necessary to feed them occasionally, using for this purpose the foliage from

the kinds of trees from which they were collected, or a variety of foliages, placing the small branches of foliage in bottles of water in order to keep them fresh. The foliage should be changed as required (every three, four, or five days) during the life of the beetles. As the beetles die, those remaining on the surface should be removed and preserved for future reference.

Two or three grubs should be preserved the fall of the first and second years, respectively. They may best be preserved by placing in test tubes of water and heating to nearly the boiling point. The grubs are allowed to remain in the heated water about ten minutes or until the liquid is quite cooled, after which they are preserved in 70 or 80 per cent alcohol.

When the grubs are nearly mature (first of July of third year in Northern States and probably the second year in the Southern States) part of the cages should be examined and grubs removed to 1 ounce shallow tin salve boxes with earth and a grain of corn. These should be examined often to determine the date of pupation and later the date of emergence of the mature beetles. Pupae of each species should be preserved.

In order to determine what species are known to injure crops and which species are of the most economic importance in the various localities, it is desirable that collections of larvae be made following the plow and data on the rotation the past three years noted. From this source it is also possible to secure data on the preference of the female for certain soils and crops for oviposition. If the observer has an opportunity to collect grubs but has not the opportunity to care for them they may be sent to us in shallow tin boxes, one grub to a box. Grubs collected from the furrow should be placed in shallow 1 ounce tin boxes (only one grub to a box) with earth and a grain of corn. Water and replace the corn as needed, and with a little care the adult beetle can be reared.

If the collector has an opportunity to send specimens to us early in the season they will be promptly returned, properly identified and with notes on the distinguishing characters. Or, if any one contemplates rearing Lachnosterna we will furnish all available data concerning the species known to inhabit his locality. For many States our data are very meager, which makes it most desirable that extensive collections be made wherever possible. This is especially true of the Southern States. Our knowledge of the food habits of many species is also meager and information along this line, either from night collections or from rearing-cage feeding records, is very desirable. Where possible, material should be preserved in 70 or 80 per cent alcohol, never in formaldehyde. If the collector prefers to pin the specimens, then the sexual organs should be extruded. Parasites may be reared by confining in 12-inch pots large numbers of beetles collected from trees when most abundant or a little later, to be fed as those in rearing cages. Parasitized beetles should be removed to other sunken pots and kept until the following spring.

On several occasions alfalfa weevils have been found by Messrs. Creel and Bennion at Butte, Mont., in potatoes shipped in refrigerator cars from Ogden, Utah.

Under date of August 5 Mr. Luginbill reports Laphygma larvae about full grown and ready to pupate. The first generation was reported through other sources as present in southern Georgia and Alabama.

Mr. McConnell has a unique and important investigation in progress on Cerotoma trifurcata. The larvae of this beetle destroys the nitrogen nodules on the roots of the cowpea. As these nodules are the most abundant on plants in the poorer soils where the nitrogen is most needed, these larvae are likely to reduce greatly the fertilizing value of this plant.

Under the new regulations it is expected that expense accounts will be promptly audited and if correct will be as promptly paid. Care should be taken to see that accounts are correct before submitting them. Remember that everyone in the Department, except the party presenting the voucher, is prohibited from changing. correcting, or adding to the same, no matter how trivial the error or how simple the correction may be. The auditor can pass, suspend, or disallow in accordance with the regulations by which he must abide, but he can not so much as change a letter in the document itself. Have your vouchers complete and correct so that you may receive your check promptly. Subvouchers should be properly filled and correctly signed. Travel should show points from which and to which journey was made. Per diem should show time and date of leaving official station as well as of arrival on returning. For the form for presenting and making up accounts see page 43 of the Fiscal Regulations.

What is true in rendering accounts is equally true in submitting field notes for copying for permanent record. These must be made clear and concise. Superfluous words are dangerous at best and should be eliminated. The aim should be not only to make all records clear, but so clear as to prevent their being misunderstood, or so that your bitterest enemy could not misrepresent or misconstrue them, and in that way make sure that you will always appear in your notes as you wish to be put on record. Leave no editing to be done in the office, as it is dangerous both for you and the division, with your own future reputation at stake. Field notes are the product of a single pair of eyes and one brain; no one else, no matter how careful, can put themselves in the place of the original observer and attempt accurately to translate and transcribe what nature has taught him.